

GROUP 14

ENGINE COOLING

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SERVICE SPECIFICATIONS

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Item		Standard value	Limit
Valve opening pressure of radiator cap kPa (psi)		93 – 123 (13.5 – 17.8)	Minimum 83 (12.0)
Range of coolant antifreeze concentration of radiator %		30 – 60	–
Thermostat	Valve opening temperature of thermostat °C (°F)	87 ± 2 (189 ± 3)	–
	Full-opening temperature of thermostat °C (°F)	95 (203)	–
	Valve lift mm (in)	8 (0.3) or more	–

LUBRICANTS

M1141000402099

Item	Specified coolant	Quantity dm ³ (qt)	
Engine coolant	MITSUBISHI MOTORS GENUINE SUPER LONG LIFE COOLANT PREMIUM or equivalent* ¹	M/T	4.0 (4.2)* ²
		CVT	4.6 (4.8)* ²

NOTE:

- *¹: similar high quality ethylene glycol based non-silicate, non-amine, non-nitrate and non-borate coolant with long life hybrid organic acid technology
- *²: includes 0.5 dm³ (0.53 qt) in the condense tank

ENGINE COOLING DIAGNOSIS

INTRODUCTION

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The system cools the engine so that it does not over-heat and maintains the engine at an optimum temperature. The system components are the radiator, water pump, thermostat, cooling fan. Possible faults include low coolant, contamination, belt loosening and component damage.

TROUBLESHOOTING STRATEGY

M1141005200403

Use these steps to plan your diagnostic strategy. If you follow them carefully, you will be sure to find most of the engine cooling faults.

1. Gather information from the customer.
2. Verify that the condition described by the customer exists.
3. Find and repair the malfunction by following the SYMPTOM CHART.
4. Verify that the malfunction is eliminated.

SYMPTOM CHART

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Symptom	Inspection procedure	Reference page
Coolant leak	1	P.14-3
Engine overheating	2	P.14-3

SYMPTOM PROCEDURES

Inspection Procedure 1: Coolant Leak

DIAGNOSIS

STEP 1. Check for coolant leaks.

⚠ WARNING

When pressure testing the cooling system, slowly release cooling system pressure to avoid getting burned by hot coolant.

⚠ CAUTION

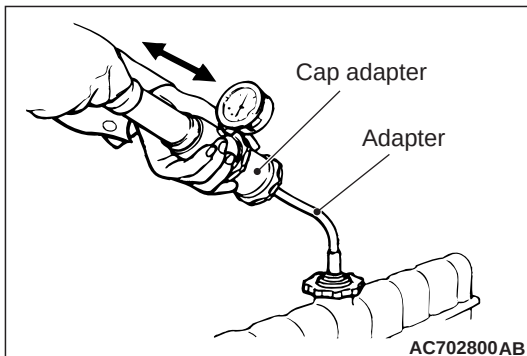
- Be sure to completely clean away any moisture from the places checked.
- When the tester is removed, be careful not to spill any coolant.
- When installing and removing the tester and when testing, be careful not to deform the filler neck of the radiator.

Check that the coolant level is up to the filler neck. Install a radiator tester and apply 160 kPa (23.2 psi) pressure, and then check for leakage from the radiator hose or connections.

Q: Is leakage present from the radiator hose or connections?

YES : Repair or replace the appropriate part, then go to Step 2.

NO : There is no action to be taken.



STEP 2. Retest the system.

Q: Is there still coolant leakage?

YES : Return to Step 1.

NO : The procedure is complete.

Inspection Procedure 2: Engine Overheating

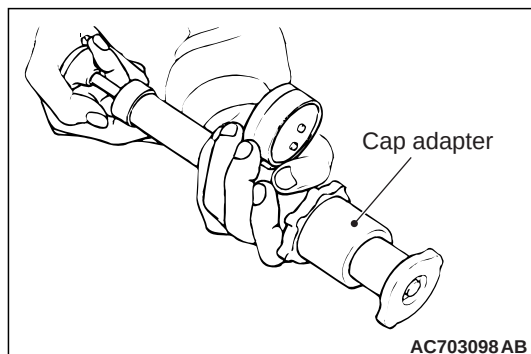
DIAGNOSIS

STEP 1. Remove the radiator cap and check for coolant contamination.

Q: Is the coolant contaminated with rust and oil?

YES : Replace it. Refer to [P.14-6](#).

NO : There is no action to be taken. Go to Step 2.

**STEP 2. Check the radiator cap valve opening pressure.**

NOTE: Be sure that the cap is clean before testing. Rust or other foreign material on the cap seal will cause an improper reading.

- (1) Use a cap adapter to attach the cap to the tester.
- (2) Increase the pressure until the gauge indicator stops moving.

Minimum limit: 83 kPa (12.0 psi)

Standard value: 93 – 123 kPa (13.5 – 17.8 psi)

Q: Does the reading remain at or above the minimum limit?

YES : Go to Step 3.

NO : Replace the radiator cap. Then go to Step 5.

STEP 3. Check thermostat operation.

Refer to [P.14-12](#).

Q: Does the thermostat operate correctly?

YES : Go to Step 4.

NO : Replace the thermostat, then go to Step 5.

STEP 4. Check the drive belt for slippage or damage.

Refer to GROUP 00, Maintenance Service – Drive Belts
[P.00-68](#).

Q: Is the drive belt loose or damaged?

YES : Adjust or replace the drive belt, then go to Step 5.

NO : There is no action to be taken.

STEP 5. Retest the system.

Check the engine coolant temperature.

Q: Is the engine coolant temperature abnormally high?

YES : Return to Step 2.

NO : The procedure is complete.

SPECIAL TOOL

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Tool	Tool number and name	Supersession	Application
MB991871	MB991871 LLC changer	General service tool	Coolant refilling

ON-VEHICLE SERVICE

ENGINE COOLANT LEAK CHECK

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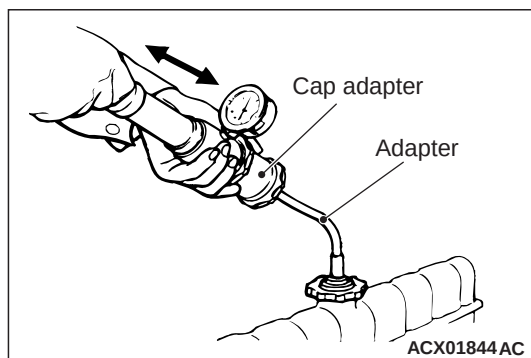
⚠ WARNING

When pressure testing the cooling system, slowly release cooling system pressure to avoid getting burned by hot coolant.

⚠ CAUTION

- Be sure to completely clean away any moisture from the places checked.
- When the tester is taken out, be careful not to spill any coolant.
- Be careful when installing and removing the tester and when testing not to deform the filler neck of the radiator.

1. Check that the coolant level is up to the filler neck. Install a radiator tester and apply 160 kPa (23.2 psi) pressure, and then check for leakage from the radiator hose or connections.
2. If there is leakage, repair or replace the appropriate part.



RADIATOR CAP VALVE OPENING PRESSURE CHECK

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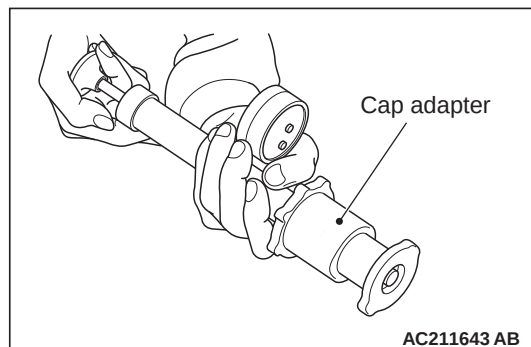
NOTE: Be sure that the cap is clean before testing. Rust or other foreign material on the cap seal will cause an improper reading.

1. Use a cap adapter to attach the cap to the tester.
2. Increase the pressure until the indicator of the gauge stops moving.

Limit: Minimum 83 kPa (12.0 psi)

Standard value: 93 – 123 kPa (13.5 – 17.8 psi)

3. Replace the radiator cap if the reading does not remain at or above the limit.



ENGINE COOLANT REPLACEMENT

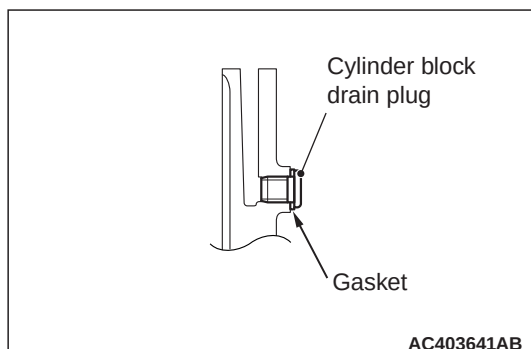
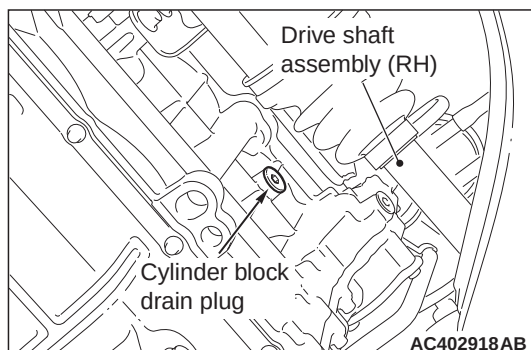
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1. Remove the engine room under cover front (Refer to GROUP 51 – Under Cover [P.51-15](#)).

⚠ WARNING

When removing the radiator cap, use care to avoid contact with hot coolant or steam. Place a shop towel over the cap and turn the cap counterclockwise a little to let the pressure escape through the vinyl tube. After relieving the steam pressure, remove the cap by slowly turning it counterclockwise.

2. Drain the engine coolant from the radiator, heater core and engine after unplugging the radiator drain plug and removing the radiator cap.
3. Drain the engine coolant in the water jacket by unplugging the drain plug of the cylinder block.
4. Remove the condenser tank and drain the engine coolant.



5. Replace the gasket, and tighten the cylinder block drain plug to the specified torque.

Tightening torque: 25 ± 3 N·m (18 ± 2 ft-lb)

6. Securely tighten the drain plug of the radiator.
7. Reinstall the condenser tank.

⚠ CAUTION

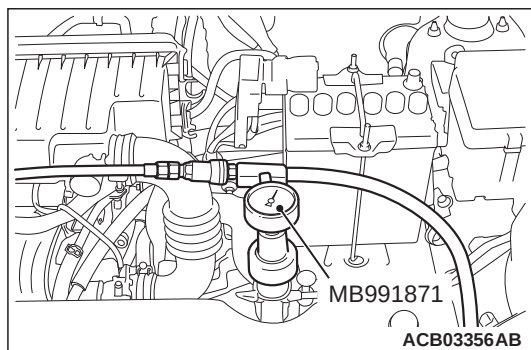
- Do not use alcohol or methanol anti-freeze or any engine coolants mixed with alcohol or methanol anti-freeze. The use of an improper anti-freeze can cause corrosion of the aluminum components.
 - Use the MITSUBISHI MOTORS GENUINE SUPER LONG LIFE COOLANT PREMIUM without adding water because the concentration is preadjusted to 50%.
8. Use special tool LLC changer (MB991871) to refill the engine coolant up to the top of the radiator port.

Recommended antifreeze: MITSUBISHI MOTORS GENUINE SUPER LONG LIFE COOLANT PREMIUM or equivalent*

NOTE: *similar high quality ethylene glycol based non-silicate, non-amine, non-nitrate and non-borate coolant with long life hybrid organic acid technology

Quantity (Includes volume inside condense tank):

- M/T: 4.0 dm³ (4.2 quarts)
- CVT: 4.6 dm³ (4.8 quarts)



NOTE: For how to use special tool MB991871, refer to its manufacturer's instructions.

9. Tighten the radiator cap securely.
10. Remove the condenser tank cap, and add the engine coolant up to the "F" line of the condenser tank.
11. Turn the A/C switch to OFF position to start the engine and warm up until the cooling fan operates.

NOTE: This work is to open the thermostat fully.

12. Rev the engine several times and then stop it. Check that there are no coolant leaks.
13. Remove the radiator cap with the engine cool, and then refill the engine coolant up to the top of the radiator port.
14. Tighten the radiator cap securely.

⚠ CAUTION

Do not overfill the condenser tank.

15. Remove the condenser tank cap, and add the engine coolant up to the "F" line of the condenser tank.
16. Install the engine room under cover front (Refer to GROUP 51 – Under Cover [P.51-15](#)).

ENGINE COOLANT CONCENTRATION CHECK

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⚠ CAUTION

- Engine coolant of less than 30% concentration has a less rust-proof effect. In a concentration of over 60%, the antifreeze effect and engine cooling performance of the engine coolant are deteriorated, causing a detrimental effect on the engine. Therefore, observe the service concentration range without fail.
- Use the MITSUBISHI MOTORS GENUINE SUPER LONG LIFE COOLANT PREMIUM without adding water because the concentration is preadjusted to 50%.

Using a hydrometer, check if the engine coolant concentration is within the standard value range.

Standard value: 30 to 60% (service concentration range)

WATER PUMP ENGINE COOLANT LEAK CHECK

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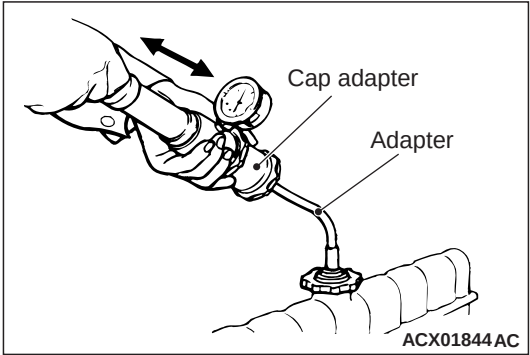
Even when the water pump is normal, a residue of the engine coolant draining may be found on the drain hole, the vapor hole and the installation surface of the water pump. If a residue of the engine coolant draining is found, check the water pump leakage by following method.

1. Wipe off the residue of the engine coolant draining on the water pump.

⚠ WARNING

Make sure that the engine coolant is cold when removing the radiator cap.

2. Remove the radiator cap.



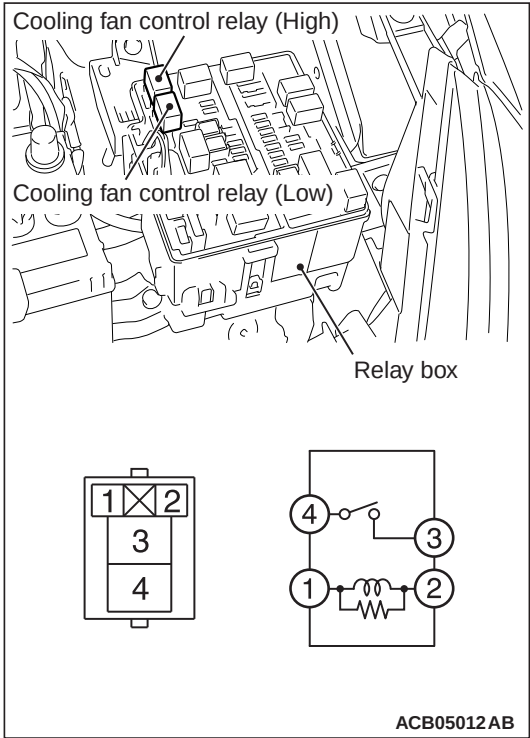
⚠ CAUTION

Do not pressures 100 kPa (14.5 psi) or more.

3. Install the radiator tester and pressures at 100 kPa (14.5 psi).
4. Hold the pressurized state for 20 minutes, and check that the engine coolant leakage from the drain hole, the vapor hole or the installation surface of the water pump.
5. Remove the radiator tester, and install the radiator cap.
6. Warm up the engine, let it idle for 20 minutes and stop it.
7. After stopping the engine, and check that the engine coolant leakage from the drain hole, the vapor hole or the installation surface of the water pump.
8. If the engine coolant leakage is found in step 4 or 7, replace the water pump (Refer to [P.14-13](#)).

COOLING FAN CONTROL RELAY CONTINUITY CHECK

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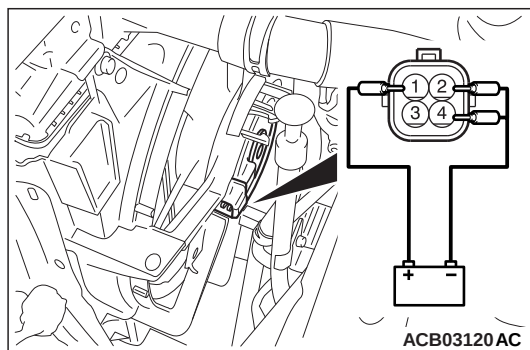
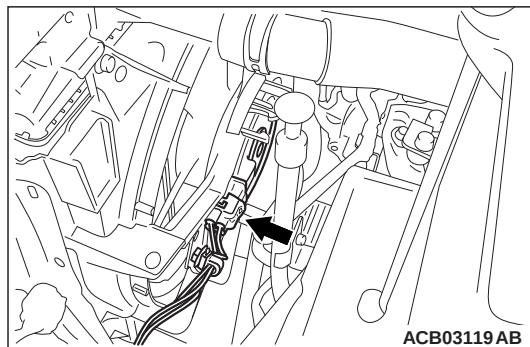


Battery voltage	Terminal No. to be connected to tester	Continuity test results
Not applied	4 – 3	Open circuit
Connect terminal No.1 and positive battery terminal. Connect terminal No.2 and negative battery terminal.		Continuity (less than 2 ohms)

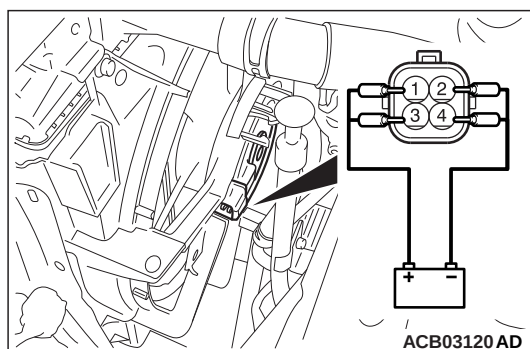
COOLING FAN MOTOR CHECK

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1. Remove the cooling fan motor connector.



2. Check that the cooling fan motor runs at low speed when a positive battery terminal is connected to the cooling fan motor-side connector terminal No.1, and terminal Nos.2 and 4 are grounded. Also check to see that there is no abnormal sound emitted from the cooling fan motor at this time.



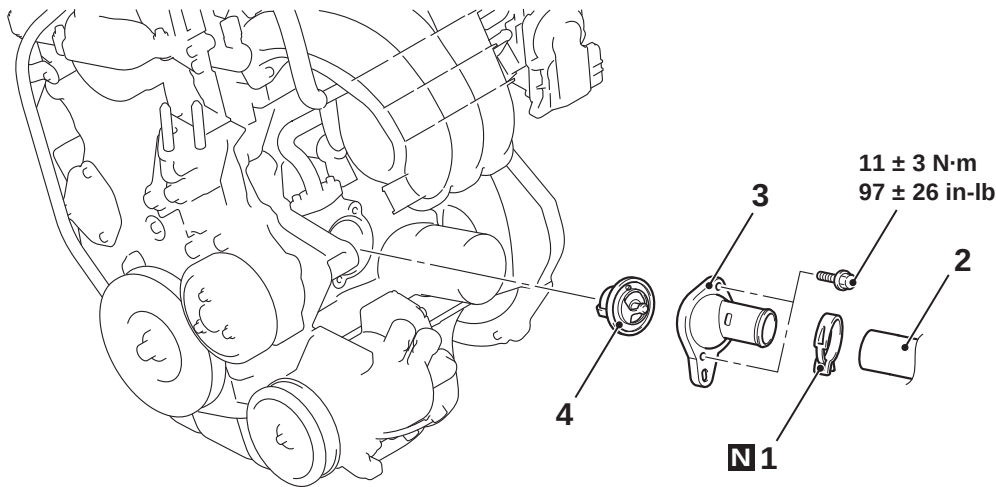
3. Check that the cooling fan motor runs at high speed when a positive battery terminal is connected to the cooling fan motor-side connector terminal Nos.1 and 3, and terminal Nos.2 and 4 are grounded. Also check to see that there is no abnormal sound emitted from the cooling fan motor at this time.
4. If the cooling fan motor is defective, replace it (Refer to [P.14-16](#)).

THERMOSTAT

REMOVAL AND INSTALLATION

M1141002403236

Pre-removal Operation • Engine Coolant Draining (Refer to P.14-6). • Generator Assembly Removal (Refer to GROUP 16 – Charging System, Generator Assembly P.16-16).	Post-installation Operation • Generator Assembly Installation (Refer to GROUP 16 – Charging System, Generator Assembly P.16-16). • Engine Coolant Refilling (Refer to P.14-6).
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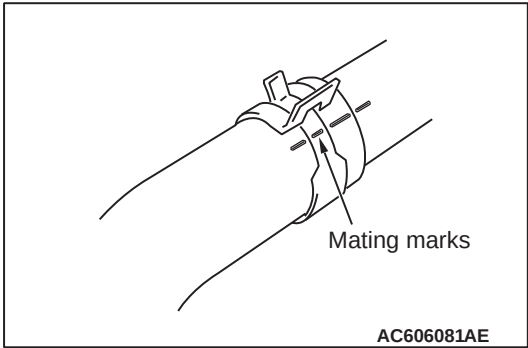
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|-------|-------|----|--------------------------------|
| <<A>> | >>B<< | 1. | Hose clip |
| <<A>> | >>B<< | 2. | Radiator lower hose connection |

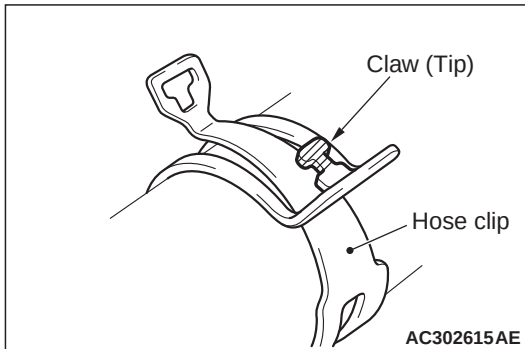
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|-------|--|----|----------------------------------|
| | | | Removal steps (Continued) |
| | | 3. | Water inlet fitting |
| >>A<< | | 4. | Thermostat |

REMOVAL SERVICE POINT

<<A>> HOSE CLIP/RADIATOR HOSE DISCONNECTION

1. Make mating marks on the radiator hose and the hose clip as shown to install them in the original position.





2. Break off the tip of hose clip claw and spread out the hose clip, then disconnect the radiator hose.

NOTE: If there is a hose clip claw, the hose clip cannot spread to capacity because the claw contacts the hose clip.

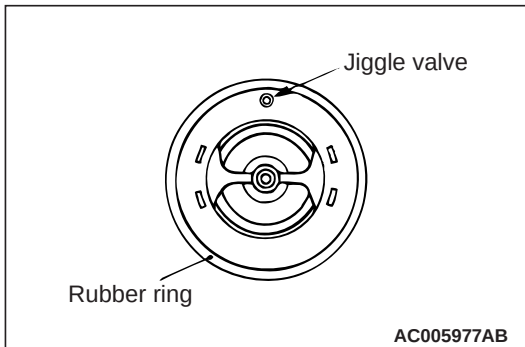
INSTALLATION SERVICE POINTS

>>A<< THERMOSTAT INSTALLATION

⚠ CAUTION

Make absolutely sure that no oil adheres to the rubber ring of the thermostat. Also do not fold or scratch the rubber ring during installation.

Install the thermostat so that the jiggle valve is facing straight up. Be careful not to fold or scratch the rubber ring.

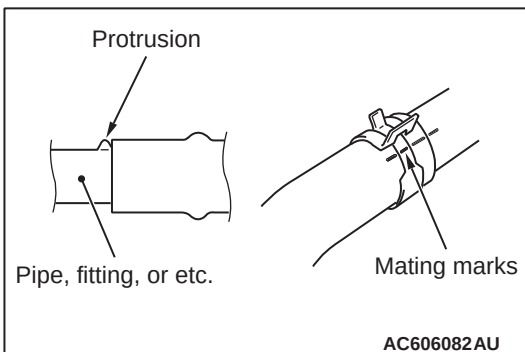


>>B<< RADIATOR HOSE/HOSE CLIP CONNECTION

⚠ CAUTION

Never reuse the hose clip whose claw is broken off to prevent the rusting.

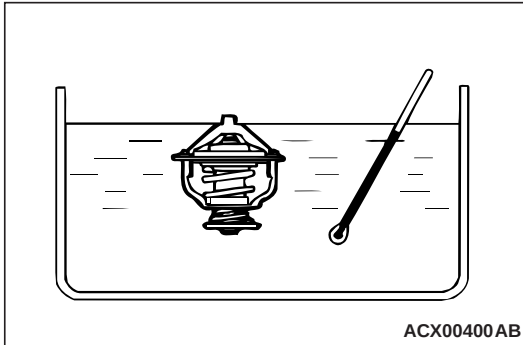
1. Make mating mark on a new hose clip in the same position as the remove one.
2. Insert the radiator hose until the protrusion of the pipe.
3. Align the mating marks on the radiator hose and hose clip.
4. Remove the hose clip claw and shorten the hose clip, then install the radiator hose.



INSPECTION

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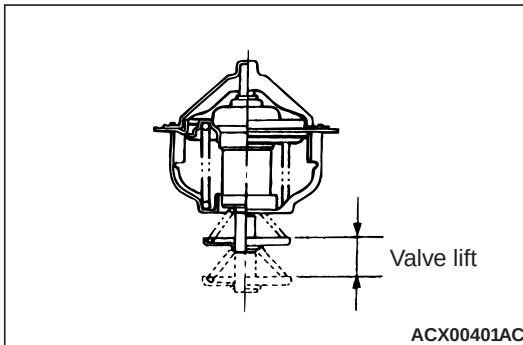
THERMOSTAT CHECK



1. Immerse the thermostat in water, and heat the water while stirring. Check the thermostat valve opening temperature.

Standard value:

Valve opening temperature: $87 \pm 2^{\circ}\text{C}$ ($189 \pm 3^{\circ}\text{F}$)



2. Check that the amount of valve lift is at the standard value when the water is at the full-opening temperature.

NOTE: Measure the valve height when the thermostat is fully closed, and use this measurement to compare the valve height when the thermostat is fully open.

Standard value:

Full-opening temperature: 95°C (203°F)

Amount of valve lift: 8 mm (0.3 inch) or more

WATER PUMP

REMOVAL AND INSTALLATION

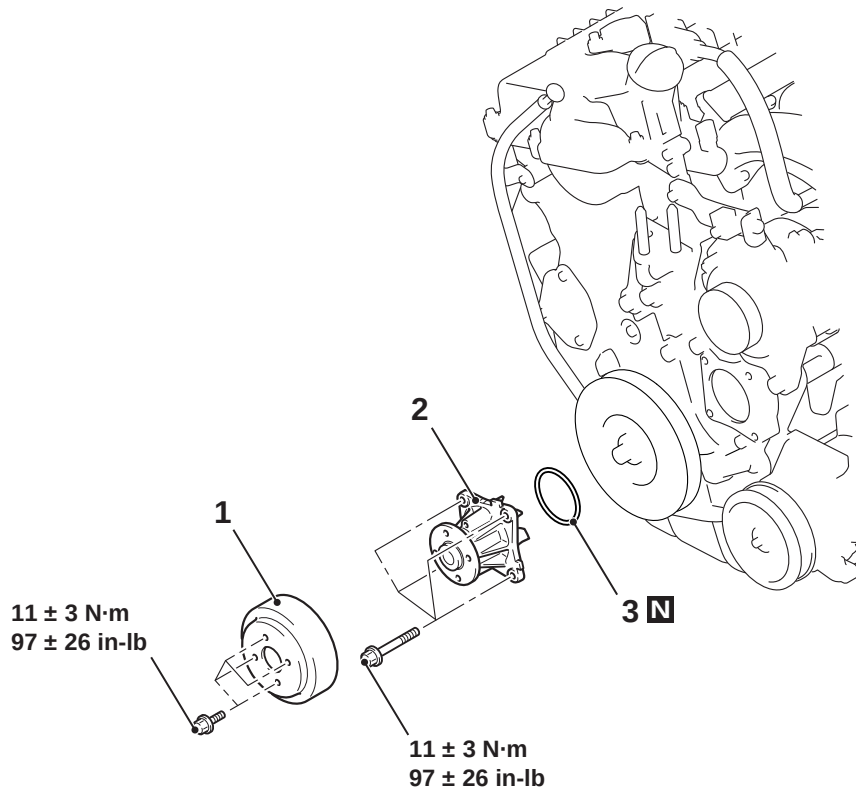
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Pre-removal Operation

- Engine Coolant Draining (Refer to [P.14-6](#)).
- Drive Belt Removal (Refer to GROUP 11A – Crankshaft Pulley [P.11A-18](#)).

Post installation Operation

- Drive Belt Installation (Refer to GROUP 11A – Crankshaft Pulley [P.11A-18](#)).
- Engine Coolant Refilling (Refer to [P.14-6](#)).



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<<A>>

Removal steps

1. Water pump pulley

Removal steps (Continued)

- >>A<< 2. Water pump
- >>A<< 3. O-ring

REMOVAL SERVICE POINT**<<A>> WATER PUMP PULLEY REMOVAL**** CAUTION**

- Do not use the drive belt set up on the vehicles.
- Do not use a cracked or damaged drive belt.

Use the used drive belt to fix the water pump pulley, and remove the water pump pulley mounting bolts.

INSTALLATION SERVICE POINT**>>A<< O-RING/WATER PUMP INSTALLATION**

1. Carefully remove the drying material and other foreign materials on the installation groove for the water pump O-ring.
2. Carefully remove the drying material and other foreign materials on the water pump installation area of the timing chain case assembly.
3. Sufficiently apply water or coolant to the O-ring to prevent it from dropping using brushes.
4. Securely fit the O-ring flange area into the installation groove of the water pump O-ring.
5. Reverse the water pump carefully and check that the O-ring does not fall down.

** CAUTION**

When installing the water pump, pay attention not to let the O-ring fall down or be bitten. Otherwise, a coolant leak may be caused.

6. Install the water pump to the timing chain case assembly.

WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

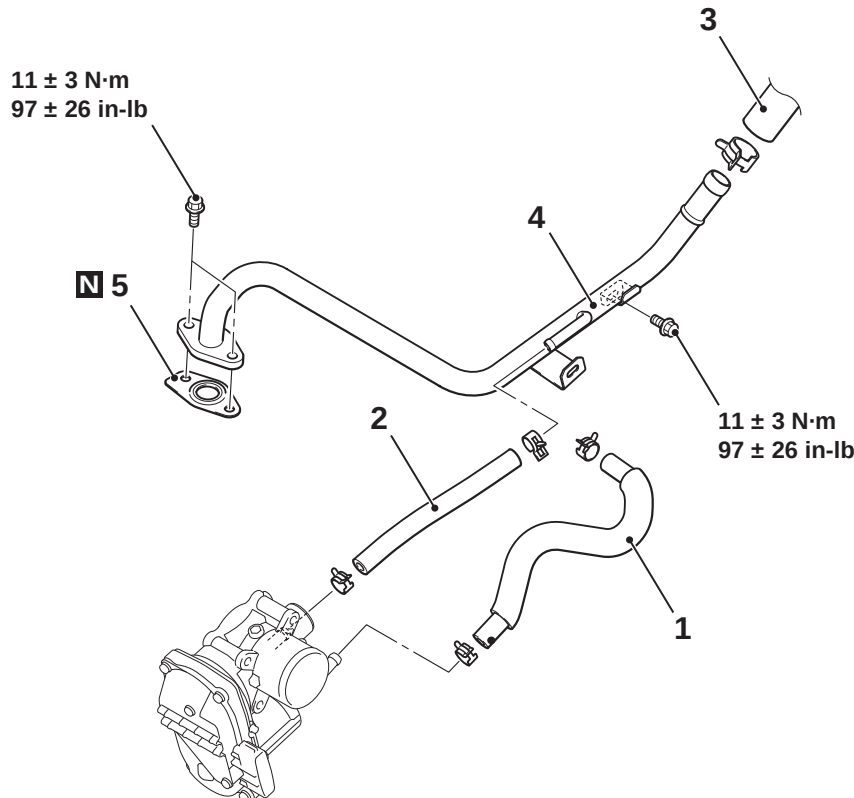
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Pre-removal Operation

- Battery and Battery Tray Removal (Refer to GROUP 54A – Battery [P.54A-7](#)).
- Intake Manifold Removal (Refer to GROUP 15 – Intake Manifold [P.15-6](#)).

Post-installation Operation

- Intake Manifold Installation (Refer to GROUP 15 – Intake Manifold [P.15-6](#)).
- Battery and Battery Tray Installation (Refer to GROUP 54A – Battery [P.54A-7](#)).



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- >>B<<**
- Removal steps**
1. Water hose A
 2. Water hose B
 3. Heater water hose B connection

- >>A<<**
- Removal steps (Continued)**
4. Water pipe
 5. Water pipe gasket

INSTALLATION SERVICE POINTS

>>A<< WATER PIPE GASKET INSTALLATION

For the installation procedure, refer to GROUP 11B – Water Hose and Pipe [P.11B-19](#).

>>B<< WATER HOSE A INSTALLATION

For the installation procedure, refer to GROUP 11B – Water Hose and Pipe [P.11B-19](#).

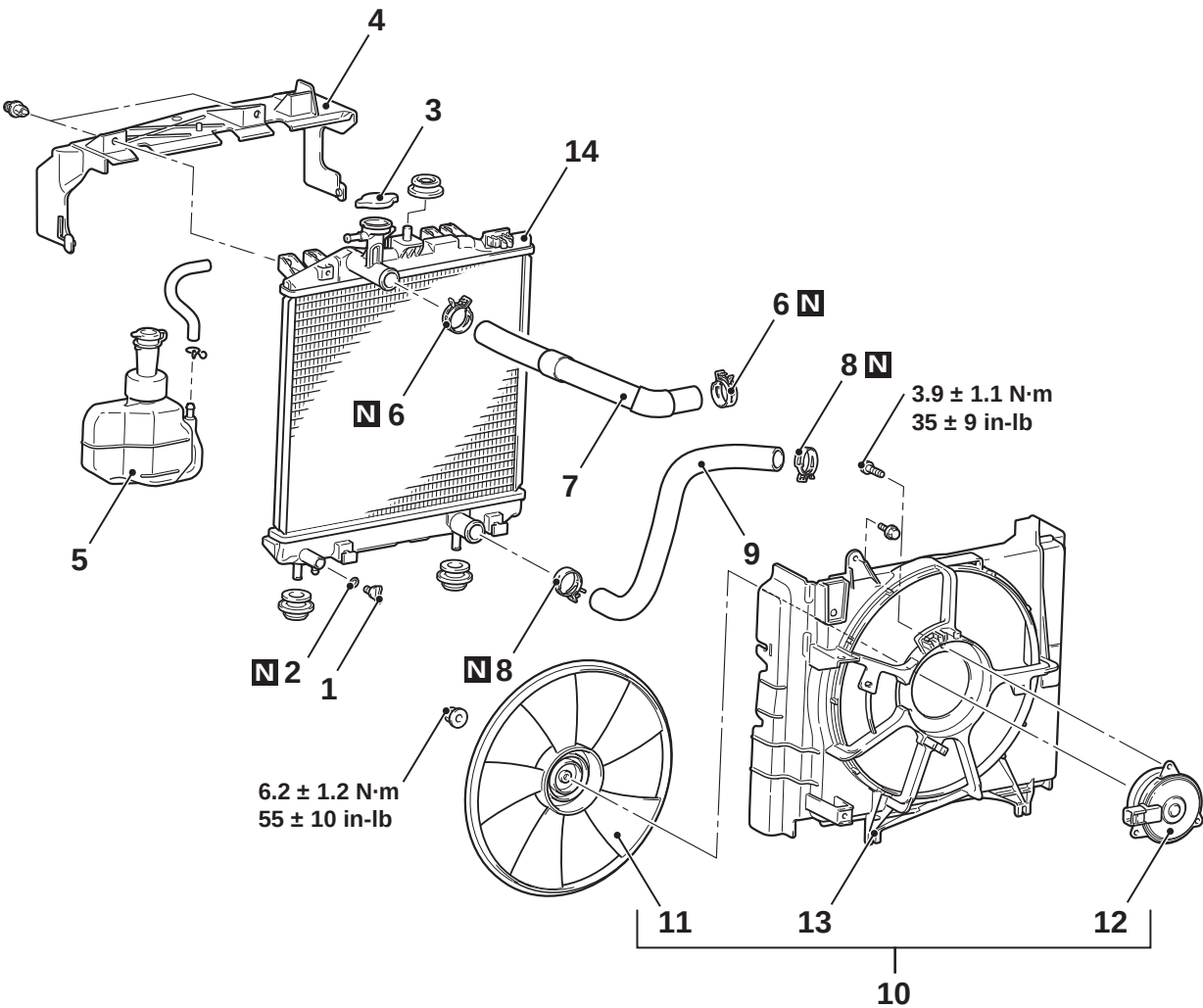
RADIATOR

REMOVAL AND INSTALLATION

M1141001503984

Pre-removal Operation • Engine Coolant Draining (Refer to P.14-6). • Front End Upper Bar Removal (Refer to GROUP 42A – Loose Panel P.42A-101).	Post-installation Operation • Front End Upper Bar Installation (Refer to GROUP 42A – Loose Panel P.42A-101). • Engine Coolant Refilling (Refer to P.14-6).
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<M/T>



ACC06860 AB

Removal steps

1. Radiator drain plug
2. O-ring
3. Radiator cap
4. Air guide panel
5. Condenser tank assembly
6. Hose clip
7. Radiator upper hose
8. Hose clip
9. Radiator lower hose

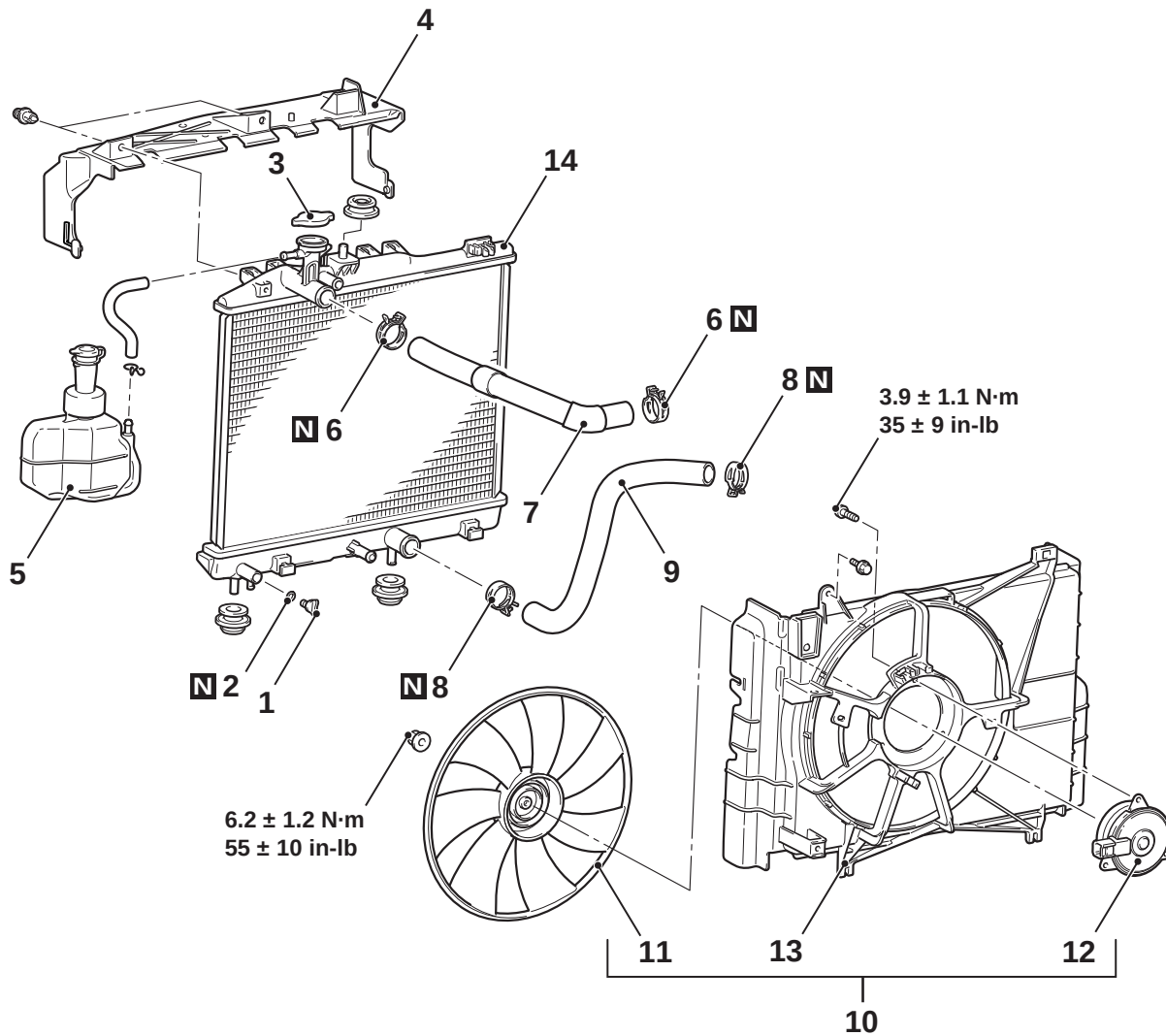
Removal steps (Continued)

10. Blower assembly
11. Cooling fan
12. Cooling fan motor
13. Cooling fan shroud
- A/C refrigerant condenser assembly (Refer to GROUP 55A – Condenser Assembly P.55A-48) <Vehicles with A/C>.
14. Radiator

<>

<<A>> >>A<<
<<A>> >>A<<
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<CVT>



ACC04354 AB

Removal steps

1. Radiator drain plug
2. O-ring
3. Radiator cap
4. Air guide panel
5. Condenser tank assembly
6. Hose clip
7. Radiator upper hose
8. Hose clip
9. Radiator lower hose
- Water hose connection (Refer to GROUP 23A – CVT Fluid Cooler Line P.23A-143).

Removal steps (Continued)

10. Blower assembly
11. Cooling fan
12. Cooling fan motor
13. Cooling fan shroud
- A/C refrigerant condenser assembly (Refer to GROUP 55A – Condenser Assembly P.55A-48) <Vehicles with A/C>.
14. Radiator

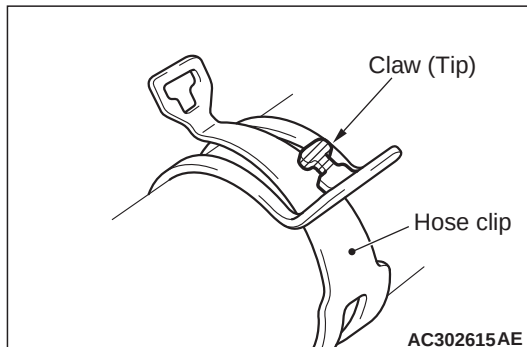
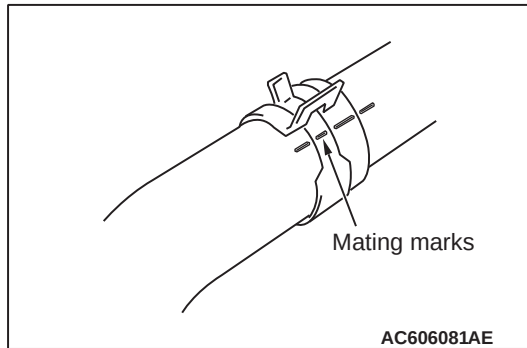
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REMOVAL SERVICE POINTS

<<A>> HOSE CLIP/RADIATOR HOSE REMOVAL

1. Make mating marks on the radiator hose and the hose clip as shown to install them in the original position.



2. Break off the tip of hose clip claw and spread out the hose clip, then disconnect the radiator hose.

NOTE: If there is a hose clip claw, the hose clip cannot spread to capacity because the claw contacts the hose clip.

<> A/C REFRIGERANT CONDENSER
ASSEMBLY REMOVAL

1. Remove the A/C refrigerant condenser assembly together with the hose and pipe from the radiator.
2. Tie the removed A/C refrigerant condenser assembly with a string at a position where they will not interfere with the removal and installation of radiator.

INSTALLATION SERVICE POINT

>>A<< RADIATOR HOSE/HOSE CLIP INSTALLATION

⚠ CAUTION

Never reuse the hose clip whose claw is broken off to prevent the rusting.

1. Make mating mark on a new hose clip in the same position as the remove one.
2. Insert the radiator hose until the protrusion of the pipe.
3. Align the mating marks on the radiator hose and hose clip.
4. Remove the hose clip claw and shorten the hose clip, then install the radiator hose.

